

Investigating Factors Affecting the Nursing Shortage During the First and Acute Phase of COVID-19: A Systematic Review

Abstract

Background: The COVID-19 pandemic has resulted in a severe shortage of nurses in health care systems worldwide. The first and acute phase of COVID-19 was challenging for health systems due to the unknown nature and complexity of the disease. This study aimed to extract the factors that influenced the shortage of nurses during the first and the acute phase of COVID-19. **Materials and Methods:** Based on the PRISMA guidelines, a systematic search was conducted in PubMed, ScienceDirect, Cochrane, Scopus, and Web of Science databases from the start of the COVID-19 outbreak to 2021. Studies were screened separately; the inclusion criteria were applied. The risk of bias was assessed with the Hoy tool, and data extraction was conducted. Factors were extracted and categorized by thematic analysis. **Results:** In total, 1035 studies were found. Finally, 11 original papers met the eligibility criteria. Most studies (seven) were cross-sectional. After thematic analysis, the results showed that the nursing shortage during the COVID-19 outbreak can be attributed to three main categories: 1) *The pandemic perceived threat*, 2) *Internal and External Factors*, and 3) *Professional and Psychosocial Support*. **Conclusions:** This study highlighted the need for the healthcare system to switch from reactive crisis management to proactive and resilient strategies. To prevent nurse burnout and attrition and guarantee the continuity of care in future emergencies, it is essential to plan to address perceived threats and strengthen support systems in addition to implementing multilevel interventions in organizational and psychological domains. This integrated strategy will convert vulnerability into readiness and resilience.

Keywords: COVID-19, nursing shortage, nursing, personnel turnover, systematic review

Introduction

The global nursing shortage, a persistent challenge even before the COVID-19 pandemic, affects both developed and developing nations.^[1] According to a 2023 World Health Organization (WHO) report, there is a global shortage of 5.8 million nurses, mainly in low- and middle-income countries such as Africa, Southeast Asia, and the WHO Eastern Mediterranean Region, as well as some parts of Latin America.^[2] It is estimated that 17% of nurses worldwide will retire within the next decade, necessitating the recruitment and training of 4.7 million nurses merely to maintain the existing staffing levels. Furthermore, an additional 10.6 million nurses will be required by 2030 to meet growing healthcare demands.^[3] While definitions of a nursing shortage may vary across different healthcare systems, it is broadly characterized by a discrepancy

between the demand for nursing services and the projected supply of qualified nurses. The concurrent surge in patients requiring care for COVID-19 and for routine medical conditions dramatically intensified the pressure on an already strained workforce.^[4] During wars, crises, disasters, and outbreaks, nursing shortages occur due to increased patient demand. Healthcare providers are needed to manage complex treatments.^[5] The COVID-19 outbreak placed immense pressure on healthcare systems with high numbers of hospitalized patients. Nurses, as frontline workers, faced significant challenges in the fight against the disease.^[6]

From January 2020 to October 12, 2021, the CDC reports 440,044 of 6,271,313 COVID-19 cases were healthcare workers, with a mortality rate of 56.42%.^[7] The cumulative incidence of COVID-19 in healthcare workers from the first to

Sara Dorri¹,
Shabnam
Shariatpanahi²,
Lida Hosseini³,
Seyedeh N.
Seyedhasani⁴,
Ahmad
Mahdizadeh^{5,6},
Mansoureh A.
Farahani⁷

¹Health Information Technology Research Center, Isfahan University of Medical Sciences, Isfahan, Iran, ²Department of Community Health Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran, ³Department of Community Health and Geriatric, School of Nursing and Midwifery, Iran University of Medical Sciences, Tehran, Iran, ⁴Department of Medical Informatics, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran, ⁵Department of Nursing, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran, ⁶Social Determinants of Health Research Center, Social Health Research Institute, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran, ⁷Nursing and Midwifery Care Research Center, Health Management Research Institute, School of Nursing and Midwifery, Iran University of Medical Sciences, Tehran, Iran

Address for correspondence:

Mansoureh A. Farahani,
Nursing and Midwifery Care
Research Center, Health
Management Research
Institute, School of Nursing and
Midwifery, Iran University of
Medical Sciences, Tehran, Iran.
Postal Code: 1996713883
E-mail: m_negar110@yahoo.
com, Farahani.ma@iums.ac.ir

Access this article online

Website: <https://journals.iwv.com/ijnmr>

DOI: 10.4103/ijnmr.ijnmr_294_24

Quick Response Code:



This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License (CC BY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Dorri S, Shariatpanahi S, Hosseini L, Seyedhasani SN, Mahdizadeh A, Farahani MA. Investigating factors affecting the nursing shortage during the first and acute phase of COVID-19: A systematic review. Iran J Nurs Midwifery Res 2026;31:555-68.

Submitted: 12-Sep-2024. **Revised:** 07-Feb-2026.

Accepted: 14-Feb-2026. **Published:** 16-Jul-2026.

third phase of COVID-19 was reported to be 809 out of 35,898 (2.2%), with nurses having the highest incidence at 42%.^[8] It was reported too that nurses had the highest mortality rate, followed by doctors and nurses.^[9] If only one percent of nurses leave the profession because of the impact of the pandemic, this would result in a loss of 280 000 nurses, and if 4 percent of nurses leave, that number will be over one million, increasing the gap between demand and supply for care for more than seven million people.^[10] For most configurations, experts recommend a ratio of 1:4 or 1:5. In casualty, intensive care, and surgery wards, the ratio of one to two patients is critical to patient safety.^[11] A study found 37.5% of ICUs struggled to meet nurse-patient ratios due to insufficient staff.^[12] Overall, the COVID-19 pandemic had a significant impact on the workload of nurses and the planning of the ratio of nurses to patients. The increased workload of nurses during COVID-19 was reflected both in the increased number of patients per nurse and the increased workload of nurses.^[13]

The first phase of COVID-19 was from December 2019 to March 2020, with the first case of pneumonia reported from Wuhan, China.^[14] This phase of incidence should be seen as a unique crisis requiring health systems worldwide to implement new reforms and to adapt their resources quickly and permanently.^[15] The acute phase was characterized by widespread virus transmission, resulting in significant morbidity and mortality in March 2020 – summer 2020. During this period, diagnostic tests and early research into possible treatments were developed.^[16] Healthcare systems faced unprecedented challenges, and various public health measures were implemented worldwide, including social distancing and personal protective equipment) PPE (mandates.^[17] This period of the pandemic was very critical because an immediate response to the outbreak had to be given. During this period, health resources were primarily diverted to emergency care, leaving other health care services, especially those dealing with older people, temporarily underresourced. This phase highlighted the importance of telemedicine and the need for psychological assessments in vulnerable groups such as the cognitively impaired.^[18]

It has been reported that various complex factors, such as career turnover and intentions to leave, were found to result from emotional distress, low resilience,^[19-21] high workload, workplace violence,^[22] and fear of illness, stress, and anxiety,^[23] which influence the nursing shortage during the COVID-19 outbreak in different countries.^[24]

The classification of nurse shortages by WHO region is crucial due to the significant differences between the various regions. These include deep economic differences in the capacity of health workers,^[25] the increasing impact of the COVID-19 pandemic on workload and attrition,^[26,27] significant training gaps in practical preparedness,^[28]

and insufficient policy interventions to build systemic resilience rather than focusing on individual resilience.^[29] This categorization is therefore of crucial importance in the development of targeted interventions. However, most literature on the shortage of nurses is done by individual studies, and more comprehensive work, such as systematic reviews, is needed. The results of a systematic review of studies published between 2010 and 2021 on the factors affecting the shortage of nurses and their impact on nurses showed that barriers such as political and planning, training and recruitment, nurses' turnover, stress, and burnout are the most important factors affecting the shortage of nurses.^[30]

Since the possibility of emerging diseases such as COVID-19 in today's world is not far-fetched, and emerging pandemics and the unforeseen circumstances resulting from them can have many adverse effects on the health care system, and given that, to the best of the researchers' knowledge, no systematic review has been conducted to investigate this gap before vaccination phase of COVID-19 pandemic, this study was conducted to systematically review the factors affecting the nursing shortage during the first and acute phase of COVID-19 pandemic based on WHO classification regions.

Materials and Methods

A systematic search was conducted on studies published from the beginning of the COVID-19 outbreak to December 2021, before the vaccination phase. Searches were limited to the English language in the PubMed, Science Direct, Cochrane, Scopus, and Web of Science databases. This systematic review was conducted based on PRISMA guidelines.^[31] The protocol has also been registered in PROSPERO database (ID: CRD42022324391). (Access link: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD4202232439).

According to the aim of the study (Which factors affect nursing shortage in COVID-19?), PEO searching was conducted: nursing as Population, COVID-19 as an Exposure, and shortage as Outcome. Also, synonymous keywords were searched to increase the search scope. In addition, the search strategy was developed using a combination of free-text keywords and MeSH to describe key concepts in the PubMed database. The search strategy was modified based on the search rules in each database under the supervision of a medical informatics specialist [Table 1]. The gray literature, government and research reports, and unpublished studies were also searched. Researchers reviewed references, searched citations, and contacted authors to reach additional studies, too. In addition, a further search on Google and Google Scholar using the mentioned keywords was conducted. In the next step, search results were imported into the EndNote X9 software. After removing the duplicates in the first step, two authors (SH and SD) of the present

Table 1: Search queries

	Key words	Queries in databases
Population	Nurses	PubMed
Exposure	(COVID-19 OR SARS-CoV-2)	(Personnel Turnover OR “turnover intention” OR “Intention to Leave” OR Retention OR Shortage OR deficiency OR attrition) AND Nurses AND (COVID-19 OR SARS-CoV-2)
Outcome	(Personnel Turnover OR “turnover intention” OR “Intention to Leave” OR Retention OR Shortage OR deficiency OR attrition)	Scopus TITLE-ABS-KEY ((((personnel AND turnover) OR “turnover intention” OR “Intention to Leave” OR retention OR shortage OR deficiency OR attrition) AND (nurses OR nursing OR nurse) AND (COVID-19 OR sars-cov-2 OR “Severe Acute Respiratory Syndrome Coronavirus 2”)))) Science Direct (Personnel Turnover OR “turnover intention” OR “Intention to Leave” OR Retention OR Shortage OR deficiency OR attrition) AND Nurses AND COVID-19 WOS You searched for: TOPIC: (((Personnel Turnover OR “turnover intention” OR “Intention to Leave” OR attrition OR Retention OR Shortage OR deficiency) AND Nurses) AND (COVID-19 OR SARS-CoV-2))

study independently reviewed the titles and abstracts to identify eligible studies. Any disagreement over eligibility was resolved by discussion until a consensus was reached among the authors. In the next step, the remaining articles were re-evaluated in terms of relevance to the purpose of the study. Then, the full texts of the remaining studies were assessed to extract related data. English articles that investigated the reasons for the nursing shortage in hospitals during the COVID-19 pandemic were included. Letters to the editor, case reports, review articles, and protocols were excluded. Also, articles investigating nursing students or other healthcare staff, and those examining the tendency of employed nurses to continue their work were excluded.

After obtaining the relevant articles according to the PRISMA checklist, two authors (L H and SN SH) of the present study independently extracted the information; any disagreement was solved by group discussions. We also consulted an expert in the field (M AF) when we did not reach an agreement. The following information was collected using an Excel 2013 form: the name of authors, country, the purpose of the study, study design, type of data collection, sampling method, data collection tools, name and type of the tool, number of tool items, number of participants, age, gender, department, working experience, and the factors affecting the nursing shortage as an outcome. Risk of bias was assessed according to the Hoy tool,^[32] which consists of 10 items addressing four domains of bias, namely selection, nonresponse, measurement, and analysis bias. The original tool has 10 binary items addressing different biases and a summary risk of bias. Items 1 to 4 assess the external validity of the studies, and items 5 to 10 assess the internal validity. Each domain is scored based on predefined criteria, typically as “Yes,” “No,” or “Unclear.” The scores are then aggregated to provide an overall risk of bias rating

for the study. The summary assessment evaluates the overall risk of bias and provides a subjective assessment of the risk of bias as low risk 0–3, moderate risk 4–6, and high risk 7–9. All data were extracted and independently reviewed by at least two authors of the present study. Any conflict was discussed with a third author (M AF) of the study. The studies with a high risk of bias were also deleted.

The thematic analysis of the extracted factors was conducted, following the framework of Braun and Clarke.^[33] The process consisted of three distinct, sequential stages: 1) Initial Coding: Two researchers independently read and re-read the extracted factors from each study to achieve deep familiarity. We then performed open coding, line-by-line, to generate initial codes that described the key concepts (e.g., “burnout,” “inadequate PPE,” “fear of infection”). This was an inductive process, allowing codes to emerge directly from the data. 2) Theme Development: We collated all initial codes and analyzed them for patterns and relationships. Similar codes were grouped to form potential candidate themes and sub-themes. This involved creating thematic maps to visualize the relationships between codes and candidate themes. 3) Reviewing and Defining Themes: The candidate themes underwent a rigorous, iterative review to ensure they accurately reflected the coded data and formed a coherent pattern across the entire dataset. Any discrepancies were resolved through research team consensus discussions. Through this process, themes were refined, split, combined, or discarded. Finally, we defined and named each theme to capture its essence precisely.^[34] Subsequently, the data were analyzed based on World Health Organization (WHO) regions, namely AFR (African Region), AMR (Region of the Pacific Region Americas), EMR (Eastern Mediterranean Region), EUR (European Region), SEAR (South-East Asia Region), and WPR (Western).

Ethical considerations

All the methods of this research were carried out in accordance with the relevant guidelines and regulations and were approved by the ethics committee of Iran University of Medical Sciences with the code of ethics (<http://ethics.research.ac.ir/IR.IUMS.REC.1401.128>). We declare that to observe the ethical principles of research. This manuscript is free from plagiarism. All authors affirm that they have adhered to the established ethical standards for conducting scholarly research and that the study was conducted with integrity, fidelity, and honesty.

Results

Characteristics of the studies

In the initial search of the electronic databases, 1035 potentially relevant studies were identified. After removing duplicate studies, the titles and abstracts of 542 studies were screened according to the eligibility criteria. Finally, 11 articles for full-text analysis were retrieved [Figure 1]. Then, the included studies were carefully reviewed, and related data were extracted.

Ten of the studies were published in 2021,^[35-44] and only one study was published in.^[45] In terms of WHO region, studies were conducted in four regions, including the Western Pacific Region (WPR), the Eastern Mediterranean Region (EMR), the Region of the Americas (AMR), and

the European Region (EUR), with the largest number of studies (six studies) in the EMR region.^[35,36,39,40,42] There were three studies in the AMR,^[37,41,43] two studies in the WPR,^[38,45] and in the EUR region.^[44] No studies were found in the AFRO and SEARO regions. The studies were conducted in nine countries. The majority of studies were cross-sectional. All of the 11 studies were performed on nurses working in hospitals, the majority of which assessed the nurses in special wards such as the ICU and the COVID-19 ward. Characteristics and the summary of included studies are presented in Table 2.

Factors related to the nursing shortage

Based on the results of the reviewed studies, the most important factors which increase nursing shortage during the COVID-19 outbreak can be generally divided into three main categories: the pandemic perceived threat, Internal and External Factors, and Professional and Psychosocial Support [Table 3].

1- The pandemic perceived threat: Nurses experienced the pandemic as a considerable perceived threat, primarily determined by their appraisal of disease severity, personal susceptibility, and the anticipated consequences for themselves, their families, and patients. Based on evidence from the reviewed studies, several main internal factors influencing nurses' perceived threat during the COVID-19 pandemic were identified with almost equal frequency: 1) in Majeed *et al.*^[39] study, fear of COVID-19 was reported

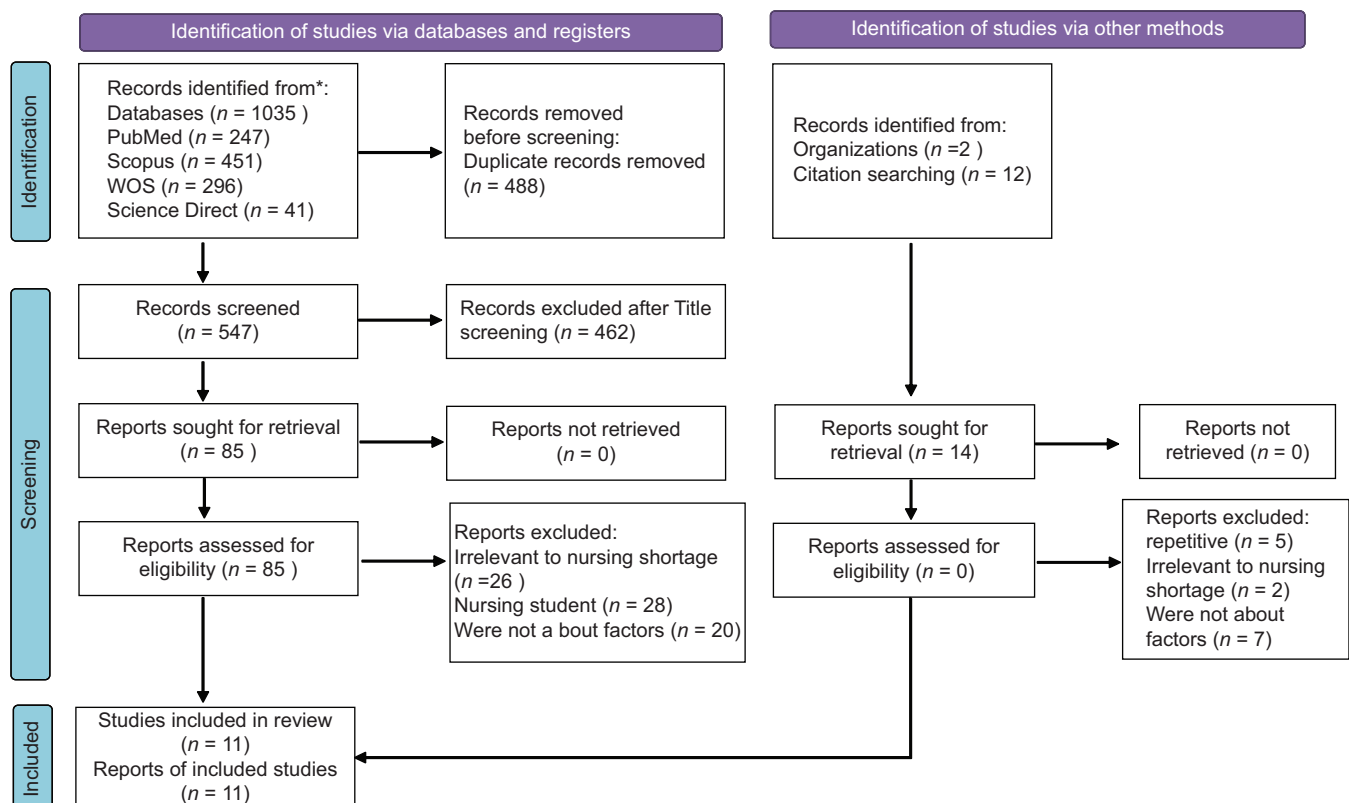


Figure 1: PRISMA flow diagram

Table 2: Included study characteristics

Author	Country year	WHO region	Aim	Design	Data collection	sampling method
Majeed ^[39]	Pakistan 2021	EMR	1- To associate between perceived risk of COVID-19 and turnover intentions 2- Investigate the mediating role of perceived fear of COVID-19 between perceived risk of COVID-19 and turnover intention. 3- Examine the buffering role of perceptions of hospital measures against COVID-19 on diminishing workers' turnover.	Longitudinal study	Self-Report	Nonrandomized (snowball sampling technique)
Raso ^[41]	USA 2021	AMR	To describe the impact of pandemic on intent to leave position	Cross-sectional, descriptive study	Self-Report	Non-randomized (convenience and snowball sampling)
Mirzaei ^[40]	Iran 2021	EMR	To identify the predictors of turnover intention based on psychosocial factors in nurses	Descriptive-analytical	Self-report	Consensus
Astin Cole ^[37]	USA (Alabama) 2021	AMR	To assess the impact of the psychological anxiety and stress on quitting job	Cross-sectional survey	Self-report	Random
Yang ^[45]	China 2022	WPR	To elucidate the effects of workplace violence on turnover intention.	Cross-sectional survey	Self-report	Non random
Alameddine ^[36]	Lebanon 2021	EMR	To investigate the level and factors associated with the resilience of nurses.	Cross-sectional	Self-report	Non random
Said ^[42]	Egypt 2021	EMR	To assess occupational stress, job satisfaction, and intent to leave among nurses.	A comparative cross-sectional study	Self-report	Non random
Wood ^[44]	UK 2021	EUR	Understand the experiences of advanced practice nurses (APNs) particularly in relation to safety, shortages and retention	A cross-sectional, mixed-methods survey.	Self-report	Non random
Khalid Al-Mansour ^[35]	Saudi Arabia 2021	EMR	Investigate the association between stress and turnover intention among healthcare and whether social support could affect this association	cross-sectional study	Self-report	Stratified
Sharma ^[43]	US 2021	AMR	To assess the impact of COVID-19 on HCPs	Cross-Sectional	Self-report	Stratified
Fan ^[38]	Singapore 2021	WPR	To understand the impact of COVID-19 on isolation bed capacity requirements, nursing workforce requirements and nurse: patient ratios	Retrospective review	Self-report	Non random
Author	scale	Scale type	Participants M (SD) OR n (%)	Ward	work experience n OR M (SD)	Factors
Majeed ^[39]	Perceived risk of Covid-19 (11 items) Fear of COVID-19 developed by Ahorsu <i>et al.</i> (7 items) Turnover intention developed by Vigoda (3 items)	Researcher-Made Standard	178 16 doctors, 103 nurses, 59 paramedics n (M): 74 n (F): 104 M (age): 21–30 years: 63 (35.4%) 31–40 years: 71 (39.9%)	COVID-19 patients ward	n=51 <1 year N=70 1–3 years n=32 3–5 years n=25 ≥5	The perception of hospital measures against COVID-19 Perceived Risk of Covid-19 Fear of COVID-19

Contd...

Table 2: Contd...

Author	scale	Scale type	Participants M (SD) OR n (%)	Ward	work experience n OR M (SD)	Factors
			41–50 years: 27 (15.2%) 50 and Above: 17 (9.6%) WE: ≥1 year: 51 (28.7) 1–3: 70 (39.3) 3–5: 32 (18) 5≤: 25 (14)			
Raso ^[41]	Intent to leave current position (1 item) Intent to leave the profession (1 item) Pandemic impact (1 item)	Researcher-Made	5087 RNsN (M): 562 N (F): 4526 M (age): 41.1 (12.2) WE: 14.5 (11.8)	Emergency care Perioperative Ambulatory/ outpatient Critical/ progressive care Medical-surgical (adult): Psychiatry Obstetrics Pediatrics	14.5 (11.8)	Role (Direct care nurses, higher intention to leave) age (39< age >60, higher intention to leave) -years of experience (experience <2 years and 3–10 years) -pandemic impact
Mirzaei ^[40]	Turnover Intention Questionnaire, IES-R 12 C-GHQ JCQ	Standard	479 N (M): 38.4% N (F): 61.6% M (age): 33.43 (6.77) WE: 9.19 (6.42)	-Emergency Department -Emergency Medicine Service. -General ICU	9.19 (6.42)	- Gender - marital status - work position - decision latitude - social support - job strain - general health - post-traumatic stress disorder (PTSD)
Astin Cole ^[37]	Questionnaire designed by Lee <i>et al</i> (2005) (four domains)	Researcher made	111 Frontline nurses	Not reported	—	- Gender - marital status - seniority - anxiety and stress related to their patients' acuity - personal health as a risk factor - patient assignments - personal protective equipment - psychological support
Yang ^[45]	The 12-item perceived social support (PSS) scale	Researcher made	1063 n (M): 33.4% n (F): 66.6% M (age): 34.1 (7.2) WE: NR	Job type Doctor or Nurse		Perceived social support Mental health Workplace violence
Alameddine ^[36]	Connor-Davidson Resilience Scale© (CD-RISC) (25 items)	Standard	265 n (M): 93 n (F): 172 M (age): NR	Not reported	n=68 <10 years n=197 >10 years	Such that those who intend to quit were less resilient.

Contd...

Table 2: Contd...

Author	scale	Scale type	Participants M (SD) OR n (%)	Ward	work experience n OR M (SD)	Factors
Said ^[42]	The Expanded Nursing Stress Scale (ENSS) (57 items)	Standard	WE: $\geq 10=68$ $\leq 10=197$ (ZFH):210 (ZGH):210 <i>n</i> (M): ZFH: 31, ZGH: 45 N (F): ZFH: 179, ZGH: 165 M (age): ZFH: 24.22 (5.16), ZGH: 26.09 (4.53) WE: ZFH: 9.45 (2.24), ZGH: 11.39 (3.96)	Not reported	ZFH group: 9.45 (2.24), ZGH group: 11.39 (3.96)	Occupational stress Job Satisfaction high stress level Workload dealing with death and dying personal demands and fears employing strict biosecurity measures stigma low satisfaction level
			questionnaire assessing specific Covid-19-associated stressors and nurses' intent to leave (19 items)			
Wood ^[44]	49 mix question	Researcher made	124 <i>n</i> (M):NR <i>n</i> (F):NR M (age): Under 40: 22 41–50: 50 Over 50: 52 WE: NR	National Health Service across primary and secondary care and covered all four nations of the UK		Not being able to provide the same standard of care as they did before the crisis not feeling their safety was prioritized -not feeling there was sufficient communication from management about coronavirus planning
Khalid Al-Mansour ^[35]	Perceived Stress Scale-10 (PSS-10) Multidimension Scale of Perceived Social Support (MSPSS)	Standard	1101 healthcare workers (242 physicians, 340 nurses, 310 paramedics, and 209 administrative workers) <i>n</i> (M): 617 (56.00%) <i>n</i> (F): 484 (44.00%) M (age): 38.9 (8.1) WE: >18	Primary healthcare centers	>18 years	Stress Social support
Sharma ^[43]	Survey	Researcher made	<i>n</i> =3182 75%Female	ICU	11.4 y	Burn out ICU nurses
Fan ^[38]	Hospital database	Researcher made	Bed occupancy and nursing workforce data	Isolation units		Nursing workforce

n (M)=number of male, N (F)=number of female, M (age)=mean age, WE=work experience, AFR=African Region, AMR=Region of the Pacific Region Americas, EMR=Eastern Mediterranean Region, EUR=European Region, SEAR=South-East Asia Region, WPR=Western

as a major concern among nurses in Pakistan, affecting willingness to work in high-risk areas and contributing to staff shortages, 2) in Cole *et al.*,^[37] a study on stress related to the risk of infection was highlighted in the US, where nurses experienced significant psychological distress due to the possibility of transmitting the virus to themselves or their families, 3) in Mirzaei *et al.*,^[40]

Post-traumatic stress disorder (PTSD) was observed among frontline nurses in Iran, particularly those exposed to high patient mortality and prolonged critical conditions, 4) in Raso *et al.*,^[41] The concept of a pandemic crisis, encompassing high workload and uncertainty that exacerbated feelings of insecurity and moral distress, was emphasized in the US and global surveys, furthermore, 5)

Table 3: Factors related to the nursing shortage

Frequencies	Author (s)	WHO region	Factors	Themes	
1	Majeed, M.	EMR	Fear of Covid-19	The Pandemic Perceived Threat	
1	Majeed, M.	EMR	Perceived Risk of Covid-19		
1	Astin Cole, H.A.	AMR	Stress related to getting infected with covid-19		
1	Mirzaei, A.	EMR	Post-traumatic stress disorder (PTSD)	External Factors internal and external Factors	
1	Raso, R.	AMR	Pandemic Crisis		
2	Said, R.M.	EMR	High stress level		
	Khalid Al-Mansour				
1	Said, R.M.	EMR	Dealing with death and dying		
1	Said, R.M.	EMR	Occupational stress		
1	Wood, E.	EUR	Not being able to provide the same standard of care as they did before the crisis		
1	Yang, Y.	WPR	Workplace violence		
2	Said, R.M.	EMR WPR	Workload		
	Fan EMP				
1	Mirzaei, A.	EMR	Decision latitude	Internal Factors Instrumental Psychological Professional and Psychosocial Support	
1	Mirzaei, A.	EMR	Job strain		
1	Said, R.M.	EMR	Stigma		
1	Mirzaei, A.	EMR	Work position		
2	Raso, R. Astin Cole, H.A.	AMR	The role of the nurse as a direct caregiver of the patient with Covid-19		
1	Wood, E.	EUR	The lack of proper communication from the manager regarding the plans to deal with Covid-19		
1	Sharma	AMR	Burn out		
1	Said, R.M.	EMR	Personal demands and fears		
1	Said, R.M.	EMR	Job Satisfaction		
1	Alameddine, M.	EMR	Low resilience		
1	Yang, Y.	WPR	Mental health		
2	Mirzaei, A.	EMR AMR	Personal level health		
	Astin Cole, H.A.				
1	Raso, R.	AMR	Age		
2	Mirzaei, A.	EMR AMR	Gender		
	Astin Cole, H.A.				
2	Mirzaei, A.	EMR AMR	Marital status		
	Astin Cole, H.A.				
2	Raso, R.	AMR	Years of experience		
	Astin Cole, H.A.				
1	Majeed, M.	EMR	The hospital measures against Covid-19		
1	Astin Cole, H.A.	AMR	Personal protective equipment		
1	Said, R.M.	EMR	Employing strict biosecurity measures		
4	Mirzaei, A.	EMR	Social support		
	Yang, Y.	WPR			
	Wood, E.	EUR			
	Khalid Al-Mansour	EMR			
1	Astin Cole, H.A.	AMR	Psychological support		

AFR=African Region, AMR=Region of the Pacific Region Americas, EMR=Eastern Mediterranean Region, EUR=European Region, SEAR=South-East Asia Region, WPR=Western

in Said and El-Shafei and Al-Mansour^[35,42] studies high levels of occupational stress were consistently reported in Egypt and Saudi Arabia, particularly in settings where

protective resources were inadequate or patient outcomes were poor. Finally, 6) in Mirzaei *et al.*,^[40] 2021 study, frequent exposure to patient mortality was identified as

an additional factor contributing to psychological strain, notably among nurses in Iran.

2- Internal and External Factors: factors among nurses during the COVID-19 pandemic can be categorized into external and internal factors. External factors, originating from the work environment, included job stress and workload, as reported by Said and El-Shafei in Egypt^[42] and in other settings (Al-Mansour^[35]; Raso *et al.*^[41]); lack of standard care compared with prepandemic conditions, highlighted by Wood *et al.*^[44] in the UK, and workplace violence, documented by Yang *et al.*^[45] in China, workload,^[42,38] freedom of action in decision-making, job strain,^[40] stigma,^[42] work position,^[40] the role of the nurse as a direct caregiver of the COVID-19 patient, and the lack of proper communication with the manager regarding the plans to deal with COVID-19 as reported in Iran by Mirzaei *et al.*,^[40] in the US by Cole *et al.*,^[37] and globally by Raso *et al.*^[37,41]

Internal factors included burnout, reported in the US by Sharma *et al.*^[43]; individual demands and fears; job satisfaction, noted in Egypt by Said and El-Shafei,^[42] low resilience, reported in Lebanon by Alameddine *et al.*,^[36] mental health, documented by Yang *et al.*^[45] in China, individual health, reported in the US by Cole *et al.*, and in Iran by Mirzaei *et al.*,^[37,40] as well as age, Raso *et al.*,^[41] gender, marital status, and work experience (years) (US, Cole *et al.* and; Iran, Mirzaei *et al.*).^[37,40] These external and internal factors influenced nurses' psychological well-being, coping strategies, and professional performance during the pandemic.

3- Professional and Psycho-social Support: Support to nurses during the COVID-19 pandemic can be categorized into instrumental (practical) support and psychological (emotional) support. Instrumental support included hospital measures against COVID-19, the provision of PPE, and the implementation of intensive protective protocols, as reported by Majeed *et al.*,^[39] Cole *et al.*,^[37] and Said and El-Shafei^[42] include instrumental and psychological support/lack of support. Instrumental support/lack of support includes hospital measures against COVID-19,^[39] personal protective equipment,^[37] and implementation of intensive protective measures in hospitals.^[42] Also, psychological support encompassed social support and direct psychological assistance, which have been highlighted in studies from Iran, Saudi Arabia, and China (Mirzaei *et al.*^[40]; Al-Mansour^[35]; Said and El-Shafei^[42]; Yang *et al.*^[45]; Cole *et al.*^[37]). The absence of any type of support was associated with increased stress, burnout, and turnover intentions among nurses.^[35,37,40,44,45]

Risk of bias

The risk of bias in the present study was assessed using the Hoy tool, which was reported as low for 90% of studies ($n = 11$) and moderate for 1 study.^[38] [Table 4].

Table 4: Risk of bias assessment

Author	1	2	3	4	5	6	7	8	9	10	level
Majeed, M. 2021	0	0	0	1	0	0	0	0	0	0	LOW
Raso, R. 2021	0	0	0	0	0	0	1	0	0	0	LOW
Sharma, M. 2021	0	0	0	1	0	0	1	0	0	0	LOW
Fan, E.M.P. 2021	1	1	0	0	1	0	1	0	0	0	Moderate
Mirzaei, A. 2021	0	1	1	0	0	0	0	0	0	0	LOW
Astin Cole, H.A. 2021	1	0	0	0	0	0	0	0	0	0	LOW
Yang, Y. 2022	0	0	0	0	0	0	0	0	0	0	LOW
Alameddine, M. 2021	0	0	0	0	0	0	0	0	0	0	LOW
Said, R.M. 2021	0	0	0	0	0	0	0	0	0	0	LOW
Wood, E. 2021	0	0	0	1	0	0	1	0	0	0	LOW
Al-Mansour, K. 2021	0	0	0	0	0	0	0	0	0	0	LOW

0 means yes, 1 means no, low risk 0–3, moderate risk 4–6, and high risk 7–9

Discussion

This systematic review identified a body of literature focusing on nursing workforce challenges during the early phase of the COVID-19 pandemic, reflecting both temporal and regional research gaps. Most studies were conducted in 2021, and only one study in 2022, highlighting the rapid but still limited scientific response to the emerging pandemic conditions.

Geographically, the studies were concentrated in four WHO regions—Eastern Mediterranean (EMR), Americas (AMR), Western Pacific (WPR), and Europe (EUR), with the largest EMR representation, while no studies were reported in Africa (AFRO) or South-East Asia (SEARO) regions, which would indicate an under-representation of some of the high-burden regions.^[35,46] This geographical imbalance is in line with the overall trend in bibliometric data. A Study by Zhang and colleagues^[47] found that more than 80 percent of COVID-19 publications related to nursing were from the United States, China, and the United Kingdom, while regions such as Africa and South-East Asia contributed little despite facing a significant pandemic burden. This gap underlines the need for equitable research investment and capacity building in underrepresented regions.

Most of the research used cross-sectional design and targeted nurses in hospitals, especially in high-acuity wards such as ICUs and COVID-19 wards, reflecting the critical exposure of the front-line healthcare workforce.^[41,48] Evidence from Iran and the Philippines shows that nurses in the ICU have faced increased moral distress and burnout as a result of unnecessary care and end-of-life responsibilities.^[49,50] While these studies provide valuable insights into the experience of nurses, they do not capture the long-term psychological and professional consequences of long-term exposure to crisis. In a further systematic review and meta-analysis including 30 observational studies involving a total of 32,724 healthcare workers, most of the studies were cross-sectional and mainly carried out in higher middle-income countries.^[51] While

cross-sectional studies capture the immediate effects of stress, they often fail to capture the long-term effects of stress. A Longitudinal study by Baskin and colleagues showed that burnout and post-traumatic stress persist in nurses for two years, underlining the need for continuous mental health support.

In this review, the key factors contributing to nursing shortages during the COVID-19 pandemic were grouped in three categories: pandemic perceived threat, internal and external factors, and professional and psychosocial support. Similarly, Farahani *et al.*,^[52] identified seven domains – personal, interpersonal, organizational, emotional, educational, protective, and social media-related – as the main determinants of the retention of nurses in a systematic review of 18 studies. Perceived threat is commonly understood as the result of an assessment of a stressor relative to one's perceived ability to deal with the stressor.^[53] This assessment process is particularly important in high-stakes environments such as health care settings during public health emergencies. During the COVID-19 pandemic, perceived threat emerged as a central psychological construct influencing nurses' emotional responses and coping behaviors. The unprecedented nature of the crisis has exposed nurses to a range of stresses, including fear of infection or death and fear of transmission to their loved ones,^[20] shortage of basic supplies, uncertainty about the path of the pandemic, frequent changes in guidance, limited information, increased workload, irregular timetables and changing hospital policies.^[20,36,42,45]

In the face of these cumulative pressures, some health professionals have resorted to maladaptive coping strategies as a mechanism to cope with the overwhelming perceived threat.^[54-56] These responses, while understandable, often exacerbated psychological distress and undermined professional functioning. Empirical evidence has since confirmed that elevated levels of anxiety, stress, and moral distress among nurses are closely tied to perceived threat, reinforcing its role as a key determinant of mental health outcomes and professional commitment.^[57,58] Notably, fear of COVID-19—a core manifestation of perceived threat—was identified as an independent predictor of turnover intention among frontline nurses, illustrating how psychological strain can translate into workforce attrition.^[59] This finding underscores the broader organizational implications of unmanaged perceived threat, particularly in sustaining healthcare capacity during crises. To address these challenges, structured interventions have been proposed to buffer the impact of perceived threat. Organizational moderators such as adequate PPE, clear leadership communication, targeted training, and access to rest and psychological support have consistently been associated with reduced distress among healthcare workers.^[60,61] These protective factors not only mitigate immediate

psychological harm but also foster a sense of safety and control, which are essential for adaptive coping.

Furthermore, evidence syntheses suggest that multi-component interventions can effectively reduce perceived threat and associated distress. However, the certainty of evidence remains low to moderate, and the success of such programs is highly dependent on implementation quality and contextual relevance.^[62,63]

During the COVID-19 pandemic, nurses faced a wide range of internal and external factors that significantly influenced their psychological well-being, coping strategies, and professional performance. Internal factors included occupational burnout, individual fears and demands, job satisfaction, resilience, physical and mental health status, age, gender, marital status, and work experience. Burnout was particularly associated with negative patient outcomes, increased errors, reduced satisfaction, and a higher intention to leave the profession.^[63] Turnover intention often served as a defensive strategy to protect nurses' physical, mental, and emotional resources.^[39] While a stressful work environment, understaffing, and reduced job satisfaction were key drivers of this problem, other issues, such as salary and career opportunities, also influenced nurses' willingness to remain in their profession.^[36,40,42] Resilience played a protective role, reducing susceptibility to stress and enhancing coping capacity.^[53] Studies suggest that resilience was generally higher among women,^[64-66] highlighting the need for programs that strengthen female nurses' resilience and help them balance work and family responsibilities.^[36,43] Marital status was also influential; married nurses with children were often less willing to participate in anti-pandemic programs due to their sense of responsibility toward family, whereas unmarried personnel appeared more flexible.^[36,37,65,67] Moreover, factors such as age, education level, and work experience shaped nurses' tendency to continue working,^[65] with the loss of experienced nurses being especially damaging during viral outbreaks.^[37] At the same time, positive feelings and self-efficacy encouraged commitment to the profession, underscoring the importance of identifying fear sources, enhancing crisis support systems, and offering in-service training to prevent workforce shortages.^[67]

External factors also contributed to the shortage of nurses. Stressful workplace conditions such as high workload, exposure to critical patients and death, and violence intensified during the pandemic, creating additional burdens.^[36] Workplace violence was particularly prevalent, with reports from countries such as Egypt, Malaysia, and Jordan indicating high rates of aggression toward healthcare staff.^[68-70] Violence and stigma not only damaged nurses' mental health but also fostered burnout, reduced performance, and increased turnover intentions. Addressing these challenges requires comprehensive social support systems.^[45] Social support—defined as emotional, instrumental, or informational assistance—helps mitigate

stress, reduce burnout, and improve disaster response.^[71] During the pandemic, nurses required strong support from their managers, both in practical aspects such as safety measures and compensation, and in psychological aspects such as reassurance, clear communication, and self-care programs.^[21,38,40,42,45,72] When nurses perceive cohesive and supportive environments, they are less inclined to leave their organizations.^[40,42,45,72,73] In addition, external stressors such as lack of standard care compared with prepandemic conditions,^[62] limited freedom in decision making,^[74] and poor communication with management regarding COVID-19 protocols were frequently reported in studies from Iran, the US, and the UK.^[73,75-77] These factors contributed to moral distress and reduced professional autonomy, further intensifying psychological strain. In a systematic review by Fekih-Romdhane *et al.*,^[78] similar findings were reported, showing that frontline nurses exposed to high-risk care without adequate support experienced elevated burnout driven by workload, limited control, and emotional strain.

During the COVID-19 pandemic, professional and psychosocial support emerged as a critical determinant of nurses' well-being, resilience, and ability to sustain their professional roles. Support mechanisms can be broadly categorized into two domains: instrumental (practical) and psychological (emotional). Instrumental support encompassed tangible organizational measures such as the provision of personal PPE, the implementation of intensive protective protocols, and hospital-level interventions to mitigate viral exposure. Studies conducted in Egypt, Pakistan, and the United States demonstrated that adequate instrumental support was associated with lower levels of occupational stress and reduced turnover intentions.^[42,79-83] Conversely, deficiencies in these measures—such as PPE shortages, inconsistent safety protocols, and lack of managerial coordination—were linked to heightened anxiety, burnout, and disengagement. In the study by Havaei *et al.*,^[83] deficiencies in protective measures such as PPE shortages, inconsistent protocols, and lack of managerial coordination, were significantly associated with heightened anxiety, burnout, and disengagement among nurses.

Psychosocial support, comprising emotional assistance, psychological counseling, and social support from colleagues, family, and supervisors, played a decisive role in mitigating pandemic-related stress among nurses. Research from Iran, Saudi Arabia, China, and the United States indicated that nurses who received consistent psychological support exhibited lower burnout, better coping strategies, and a reduced likelihood of leaving their positions.^[35,37,40,45]

These findings are consistent with broader evidence from recent systematic reviews. Härkänen *et al.*^[84] found that interventions such as online counseling, mindfulness-based

programs, and peer support were effective in reducing psychological symptoms and enhancing nurses' resilience, although their impact varied across cultural and institutional contexts. Similarly, Fekih-Romdhane *et al.*^[78] reported that lack of organizational support and limited access to protective resources were among the primary drivers of nurse burnout, particularly in high-income and Western healthcare systems. A systematic review by Liang *et al.*^[85] further confirmed that nurses working in high-risk environments without adequate support experienced significantly higher levels of emotional exhaustion and depersonalization. Their meta-analysis study emphasized the importance of both structural safety measures and emotional reinforcement in preventing workforce attrition.

This systematic review reveals that the COVID-19 pandemic exposed deep structural and psychological vulnerabilities within the nursing workforce, driven by a convergence of internal and external stressors. At the core of these dynamics was perceived threat. Its interaction with internal factors such as resilience, mental health status, job satisfaction, and demographic characteristics, alongside external pressures including excessive workload, limited autonomy, workplace violence, and inadequate protective infrastructure, created a feedback loop of escalating psychological strain and workforce instability. The presence or absence of professional and psychosocial support emerged as a decisive inflection point. When nurses were equipped with adequate protective resources, clear safety protocols, and structured emotional support, their capacity to cope, adapt, and remain professionally engaged was significantly enhanced. Conversely, systemic gaps in support mechanisms amplified vulnerability, accelerated burnout, and increased turnover intentions, threatening not only individual well-being but also the operational integrity of healthcare systems.

This systematic review has several limitations that should be considered. The included studies were concentrated in only four of the six WHO regions, with no representation from Africa or South-East Asia, limiting the generalizability of findings to under-represented and potentially high-burden settings. Methodologically, the evidence base predominantly consists of cross-sectional studies, which, while valuable, preclude causal inference and longitudinal analysis. Significant heterogeneity in study settings, tools, and cultural contexts also prevented a quantitative meta-analysis, necessitating a thematic synthesis. Finally, the outcome of "nursing shortage" was primarily inferred from associated factors like turnover intention and burnout, as direct, longitudinal data on actual attrition rates were scarce in the immediate pandemic literature. Despite these constraints, the review provides a crucial consolidated insight into the multifactorial drivers of nursing workforce challenges during the peak of the global crisis.

Conclusion

These findings underscore the imperative for health systems to move beyond reactive crisis management toward proactive, resilience-oriented workforce strategies. Multilevel interventions like integrating organizational safeguards, mental health infrastructure, and adaptive human resource policies are essential to protect and empower nurses in future emergencies. By addressing both the psychological and structural dimensions of occupational risk, healthcare institutions can transform vulnerability into preparedness, ensuring that their frontline workforce remains stable, supported, and capable of sustaining care delivery under pressure.

Acknowledgments

The authors would like to thank the authors for all included articles in this study. under Grant No. 1400-3-25-22313.

Financial support and sponsorship

Nursing Care Research Center (NCRC) of Iran University of Medical Sciences

Conflict of interest

Nothing to declare.

References

- Harnois-Church PA, Horsley L, Wilhoit KW, Wei H. Addressing the nursing shortage. *Nurse Leader* 2024;22:317-21.
- Organization WH. State of the World's Nursing 2025: Investing in Education, Jobs, Leadership and Service Delivery. Geneva: World Health Organization; 2025.
- International Council of Nurses (ICN). The global nursing shortage and nurse retention. Geneva: International Council of Nurses; 2021. Available from: <https://www.icn.ch/system/files/documents/2021-07/ICN%20Workforce%20Shortage%20and%20Retention.pdf>. [Last accessed on 2026 Apr 25].
- Turale S, Nantsupawat A. Clinician mental health, nursing shortages and the COVID-19 pandemic: Crises within crises. *Int Nurs Rev* 2021;68:12-4.
- Li Y, Hockenberry JM, Chen J, Cimiotti JP. Registered nurses: Can our supply meet the demand during a disaster? *BMC Nurs* 2022;21:7.
- Garosi E, Danesh MK, Mazloumi A. Nurses and covid-19 phenomenon: Challenges and consequences. *Iran Occup Health* 2020;17:1-5.
- Lin S, Deng X, Ryan I, Zhang K, Zhang W, Oghaghare E, *et al.* COVID-19 symptoms and deaths among healthcare workers, United States. *Emerg Infect Dis* 2022;28:1624-41.
- Milambo JP, Ndirangu J, Mangala S, Simba H, Kabego L. Incidence of coronavirus disease 2019 (COVID-19) among healthcare workers during the first and second wave in the Democratic Republic of the Congo: A descriptive study. *BMC Infect Dis* 2023;23:519.
- Vera-Alanis Y, Aranda-Sanchez D, Cano-Verdugo G, Gonzalez-Angulo P, Rueda-Sanchez CB, Rojas-Martinez A. Nursing staff mortality during the Covid-19 pandemic, scoping review. *SAGE Open Nurs* 2022;8:23779608221119130.
- Buchan J, Catton H, Shaffer F. Sustain and retain in 2022 and beyond. *Int Counc Nurses* 2022;71:1-71.
- Tencic M, Roche MA. Nurse-patient ratios and infection control practices: A cross-sectional study. *Collegian* 2023;30:828-34.
- Grimm C, Dickel S, Sachkova A, Popp M, Golinski M, Fichtner F, *et al.* Targeted minimal staff-to-patient ratios are unachievable – A nationwide survey in German ICUs during the COVID-19 pandemic. *Cureus* 2021;13:e15755.
- Hoogendoorn ME, Brinkman S, Bosman RJ, Haringman J, de Keizer NF, Spijkstra JJ. The impact of COVID-19 on nursing workload and planning of nursing staff on the Intensive Care: A prospective descriptive multicenter study. *Int J Nurs Stud* 2021;121:104005.
- Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, *et al.* A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020;382:727-33.
- Stroth LC, Jahns F, Bode B, Stender M, Schmidt M, Baschnegger H, *et al.* Workforce strategies during the first wave of the COVID-19 pandemic: A retrospective online survey at intensive care units in Germany. *BMC Health Serv Res* 2024;24:407.
- Stenseth NC, Dharmarajan G, Li R, Shi ZL, Yang R, Gao GF. Lessons learnt from the COVID-19 pandemic. *Front Public Health* 2021;9:694705.
- Dorri S, Sari F, Seyedhasani SN, Atashi A, Hashemi E, Olfatbakhsh A. Practical recommendations for the preoperative screening and protective protocols in cancer surgeries during COVID-19: A systematic review. *Front Surg* 2021;8:678700.
- Iodice F, Cassano V, Rossini PM. Direct and indirect neurological, cognitive, and behavioral effects of COVID-19 on the healthy elderly, mild-cognitive-impairment, and Alzheimer's disease populations. *Neurol Sci* 2021;42:455-65.
- Bell M, Sheridan A. How organisational commitment influences nurses' intention to stay in nursing throughout their career. *Int J Nurs Stud* 2020;2:100007.
- De los Santos JA, Labrague LJ. The impact of fear of COVID-19 on job stress, and turnover intentions of frontline nurses in the community: A cross-sectional study in the Philippines. *Knee Surg Sports Traumatol Arthrosc* 2021;27:52-9.
- Wahlster S, Sharma M, Lewis AK, Patel PV, Hartog CS, Jannotta G, *et al.* The coronavirus disease 2019 pandemic's effect on critical care resources and health-care providers: A global survey. *Chest* 2021;159:619-33.
- Shi M, Zhang F, He X, Huang S, Zhang M, Hu X. Are preventive measures adequate? An evaluation of the implementation of COVID-19 prevention and control measures in nursing homes in China. *BMC Health Serv Res* 2021;21:641.
- Falatah R. The impact of the coronavirus disease (COVID-19) pandemic on nurses' turnover intention: An integrative review. *Nurs Rep* 2021;11:787-810.
- Ha TT, Thuy LT, Thanh DT. Factors affecting career turnover intention after graduation among nursing students: A cross-sectional study in Central Vietnam. *Nurs Pract Today* 2023;10:229-38.
- Riaz P, Caskey F, McIsaac M, Davids R, Htay H, Jha V, *et al.* Workforce capacity for the care of patients with kidney failure across world countries and regions. *BMJ Glob Health* 2021;6:e004014.
- Jerome-D'Emilia B, Suplee PD, Linz S. Challenges faced by new nurses during the COVID-19 pandemic. *J Nurs Scholarsh* 2022;54:772-86.
- Ghazanfari MJ, Esmaeili S, Zeydi AE, Karkhah S. Moral distress among nurses during COVID-19 pandemic: Challenges and coping strategies. *Nurs Open* 2022;9:2227-8.

28. Hurley J, Lakeman R, Moxham L, Foster K, Hazelton M, Happell B. Under prepared for practice: A qualitative study of mental health nurse undergraduate workforce preparation in Australia. *Issues Ment Health Nurs* 2024;45:850-6.
29. Muhunthan M, Olalia MA, Neretljak S, Ezekiel S, Metersky K. Building resilience in nursing through strategic policy interventions. *Int Nurs Rev* 2025;72:e13068.
30. Tamata AT, Mohammadnezhad M. A systematic review study on the factors affecting shortage of nursing workforce in the hospitals. *Nurs Open* 2023;10:1247-57.
31. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, *et al.* The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Syst Rev* 2021;10:89.
32. Hoy D, Brooks P, Woolf A, Blyth F, March L, Bain C, *et al.* Assessing risk of bias in prevalence studies: Modification of an existing tool and evidence of interrater agreement. *J Clin Epidemiol* 2012;65:934-9.
33. Braun V, Clarke V. Using thematic analysis in psychology. *Health Psychol Rev* 2006;3:77-101.
34. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med Res Methodol* 2008;8:45.
35. Al-Mansour K. Stress and turnover intention among healthcare workers in Saudi Arabia during the time of COVID-19: Can social support play a role? *PLoS One* 2021;16:e0258101.
36. Alameddine M, Bou-Karroum K, Ghalayini W, Abiad F. Resilience of nurses at the epicenter of the COVID-19 pandemic in Lebanon. *Int J Nurs Sci* 2021;8:432-8.
37. Cole A, Ali H, Ahmed A, Hamasha M, Jordan S. Identifying patterns of turnover intention among Alabama frontline nurses in hospital settings during the COVID-19 pandemic. *J Multidiscip Healthc* 2021;14:1783-94.
38. Fan EM, Nguyen NH, Ang SY, Aloweni F, Goh HQ, Quek LT, *et al.* Impact of COVID-19 on acute isolation bed capacity and nursing workforce requirements: A retrospective review. *J Nurs Manag* 2021;29:1220-7.
39. Majeed M, Irshad M, Bartels J. The interactive effect of COVID-19 risk and hospital measures on turnover intentions of healthcare workers: A time-lagged study. *Int J Environ Res Public Health* 2021;18:10705.
40. Mirzaei A, Rezakhani Moghaddam H, Soola AH. Identifying the predictors of turnover intention based on psychosocial factors of nurses during the COVID-19 outbreak. *Nurs Open* 2021;8:3469-76.
41. Raso R, Fitzpatrick JJ, Masick K. Nurses' intent to leave their position and the profession during the COVID-19 pandemic. *J Nurs Adm* 2021;51:488-94.
42. Said RM, El-Shafei DA. Occupational stress, job satisfaction, and intent to leave: Nurses working on front lines during COVID-19 pandemic in Zagazig City, Egypt. *Environ Sci Pollut Res Int* 2021;28:8791-801.
43. Sharma M, Creutzfeldt CJ, Lewis A, Patel PV, Hartog C, Jannotta GE, *et al.* Health-care professionals' perceptions of critical care resource availability and factors associated with mental well-being during coronavirus disease 2019 (COVID-19): Results from a US survey. *Clin Infect Dis* 2021;72:e566-76.
44. Wood E, King R, Senek M, Robertson S, Taylor B, Tod A, *et al.* UK advanced practice nurses' experiences of the COVID-19 pandemic: A mixed-methods cross-sectional study. *BMJ Open* 2021;11:e044139.
45. Yang Y, Wang P, Kelifa MO, Wang B, Liu M, Lu L, *et al.* How workplace violence correlates turnover intention among Chinese health care workers in COVID-19 context: The mediating role of perceived social support and mental health. *J Nurs Manag* 2022;30:1407-14.
46. Zamanzadeh V, Valizadeh L, Khajehgoodari M, Bagheriyeh F. Nurses' experiences during the COVID-19 pandemic in Iran: A qualitative study. *BMC Nurs* 2021;20:198.
47. Zhang Q, Li S, Liu J, Chen J. Global trends in nursing-related research on COVID-19: A bibliometric analysis. *Front Public Health* 2022;10:933555.
48. Baskin RG, Copel LC, Mensinger JL, Brom H. Nurse resilience, burnout, pandemic stress, and post-traumatic stress: A secondary analysis of a longitudinal cohort. *PLoS One* 2025;20:e0328976.
49. Zadi O, Tavani FM, Behshid M, Sheikhalipour Z, Rahmani P, KHodayari MT. Futile care in COVID-19: How ICU nurses' resilience impacts turnover intention? A cross-sectional descriptive study. *BMC Health Serv Res* 2024;24:1664.
50. Jimenez OB, Trajera SM, Ching GS. Providing end-of-life care to COVID-19 patients: The lived experiences of ICU nurses in the Philippines. *Int J Environ Res Public Health* 2022;19:12953.
51. Ghahramani S, Lankarani KB, Yousefi M, Heydari K, Shahabi S, Azmand S. A systematic review and meta-analysis of burnout among healthcare workers during COVID-19. *Front Psychiatry* 2021;12:758849.
52. Farahani MA, Nargesi S, Saniee N, Dolatshahi Z, Beni FH, Shariatpanahi S. Factors affecting nurses retention during the COVID-19 pandemic: A systematic review. *Hum Resour Health* 2024;22:78.
53. Paredes MR, Apaolaza V, Fernandez-Robin C, Hartmann P, Yañez-Martinez D. The impact of the COVID-19 pandemic on subjective mental well-being: The interplay of perceived threat, future anxiety and resilience. *Pers Individ Dif* 2021;170:110455.
54. Anderson-Shaw LK, Zar FA. COVID-19, moral conflict, distress, and dying alone. *J Bioethical Inq* 2020;17:777-82.
55. Sharif Nia H, She L, Kaur H, Boyle C, Fomani FK, Hoseinzadeh E, *et al.* A predictive study between anxiety and fear of COVID-19 with psychological behavior response: The mediation role of perceived stress. *Front Psychiatry* 2022;13:851212.
56. Liu S, Lithopoulos A, Zhang CQ, Garcia-Barrera MA, Rhodes RE. Personality and perceived stress during COVID-19 pandemic: Testing the mediating role of perceived threat and efficacy. *Pers Individ Dif* 2021;168:110351.
57. Elneblawi NH, Elshatarat RA, Elhefnawy KA, Ebeid IA, Aljohani MS, Alzahrani NS, *et al.* Nurses' perceptions regarding exposure to COVID-19 risks, and impact of COVID-19 outbreak on their work and psychosocial health: A cross-sectional study. *Open Nurs J* 2022;16:1-13.
58. Mazanec S, Beam P, Kloos J, McClung E, Park S, DeLozier S, *et al.* Stress, anxiety, and growth in nurses during the COVID-19 pandemic. *Online J Issues Nurs* 2023;28:1-14.
59. Labrague LJ, de Los Santos JA. Fear of COVID-19, psychological distress, work satisfaction and turnover intention among frontline nurses. *J Nurs Manag* 2021;29:395-403.
60. Kisely S, Warren N, McMahon L, Dalais C, Henry I, Siskind D. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: Rapid review and meta-analysis. *BMJ* 2020;369:m1642.
61. Shanafelt T, Ripp J, Trockel M. Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA* 2020;323:2133-4.
62. Pollock A, Campbell P, Cheyne J, Cowie J, Davis B, McCallum J, *et al.* Interventions to support the resilience and mental health of frontline health and social care professionals

- during and after a disease outbreak, epidemic or pandemic: A mixed methods systematic review. *Cochrane Database Syst Rev* 2020;11:CD013779.
63. Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, Fraile-Navarro D, Fiol-deRoque MA, Pastor-Moreno G, *et al.* Impact of viral epidemic outbreaks on mental health of healthcare workers: A rapid systematic review and meta-analysis. *J Affect Disord* 2020;277:347-57.
 64. Apisarnthanarak A, Apisarnthanarak P, Siripraparat C, Saengaram P, Leeprechanon N, Weber DJ. Impact of anxiety and fear for COVID-19 toward infection control practices among Thai healthcare workers. *Infect Control Hosp Epidemiol* 2020;41:1093-4.
 65. Afshari D, Nourollahi-Darabad M, Chinisaz N. Demographic predictors of resilience among nurses during the COVID-19 pandemic. *Work* 2021;68:297-303.
 66. Mazza C, Ricci E, Biondi S, Colasanti M, Ferracuti S, Napoli C, *et al.* A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: Immediate psychological responses and associated factors. *Int J Environ Res Public Health* 2020;17:3165.
 67. Tong L, Zhu M, Wang S, Cheong P, Van I. Nurses who are more willing to participate in the fight against COVID-19: Evidence from China. *Int J Environ Res Public Health* 2021;18:7357.
 68. Elsaid NM, Ibrahim O, Abdel-Fatah ZF, Hassan HA, Hegazy MH, Anwar MM, *et al.* Violence against healthcare workers during coronavirus (COVID-19) pandemic in Egypt: A cross-sectional study. *Egypt J Forensic Sci* 2022;12:45.
 69. Sahiran MN, Minhat HS, Saliluddin SM. Workplace violence among healthcare workers in the emergency departments in Malaysia. *J Health Res* 2022;36:663-72.
 70. Ghareeb NS, El-Shafei DA, Eladl AM. Workplace violence among healthcare workers during COVID-19 pandemic in a Jordanian governmental hospital: The tip of the iceberg. *Environ Sci Pollut Res Int* 2021;28:61441-9.
 71. Kim Y, Lee S, Cho J. A study on the job retention intention of nurses based on social support in the COVID-19 situation. *J Teach Educ Sustain* 2020;12:7276.
 72. Sharif Nia H, Arslan G, Naghavi N, Froelicher ES, Kaveh O, Sharif SP, *et al.* A model of nurses' intention to care of patients with COVID-19: Mediating roles of job satisfaction and organisational commitment. *J Clin Nurs* 2021;30:1684-93.
 73. Han P, Duan X, Zhao S, Zhu X, Jiang J. Nurse's psychological experiences of caring for severe COVID-19 patients in intensive care units: A qualitative meta-synthesis. *Front Public Health* 2022;10:841770.
 74. Abdulmohdi N. The relationships between nurses' resilience, burnout, perceived organisational support and social support during the second wave of the COVID-19 pandemic: A quantitative cross-sectional survey. *Nurs Open* 2024;11:e2036.
 75. Kackin O, Ciydem E, Aci OS, Kutlu FY. Experiences and psychosocial problems of nurses caring for patients diagnosed with COVID-19 in Turkey: A qualitative study. *Int J Soc Psychiatry* 2021;67:158-67.
 76. Bakhshi H, Shariati MJ, Basirinezhad MH, Ebrahimi H. Comparison of barriers to effective nurse-patient communication in COVID-19 and non-COVID-19 wards. *BMC Nurs* 2024;23:328.
 77. Wood E, King R, Taylor B, Robertson S, Senek M, Tod A, *et al.* Moral distress in advanced practice nurses during the COVID-19 pandemic. *Nurs Stand* 2022;37:44-50.
 78. Fekih-Romdhane F, Harb F, Al Banna S, Obeid S, Hallit S. Prevalence and risk factors of burnout symptoms among nurses during the COVID-19 pandemic: An updated systematic review and meta-analysis. *Hum Resour Health* 2025;23:48.
 79. Chaimongkol N, Anh MT, Van Dau V, Mai VT. Stress and coping strategies among frontline nurses during the COVID-19 pandemic in Vietnam. *J Health Sci Med Res* 2023;41:2022905.
 80. Haq ZU, Sher ZF, Khattak FA, Zala, Hakim M, Ullah N, *et al.* Healthcare workers safety in the COVID-19 era: The impact of pre-pandemic personal protective equipment (PPE) training in Pakistan. *BMC Health Serv Res* 2023;23:1256.
 81. Simonovich SD, Aquino E, Lattner C, Soco C, Ponder TN, Amer L, *et al.* US Nurses' challenges with personal protective equipment during COVID-19: Interview findings from the frontline workforce. *Acad Psychiatry* 2022;4:226-37.
 82. Elshaer N, Agage H. Nurses' perception and compliance with personal protective equipment and hand hygiene during the third wave of COVID-19 pandemic. *J Egypt Public Health Assoc* 2022;97:14.
 83. Havaei F, Ma A, Staempfli S, MacPhee M. Nurses' workplace conditions impacting their mental health during COVID-19: A cross-sectional survey study. *Healthcare (Basel)* 2021;9:84.
 84. Härkänen M, Pineda AL, Tella S, Mahat S, Panella M, Ratti M, *et al.* The impact of emotional support on healthcare workers and students coping with COVID-19, and other SARS-CoV pandemics – A mixed-methods systematic review. *BMC Health Serv Res* 2023;23:751.
 85. Liang Y, Peng H, Luo X, Wang M, Zhang Y, Huang H, *et al.* The impact of health emergencies on nurses' burnout: A systematic review and meta-analysis. *BMC Public Health* 2025;25:2847.